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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/715,000	11/20/2000	Hidemitsu Aoki	PF-2695	6696
466	7590	12/02/2003	EXAMINER	
YOUNG & THOMPSON 745 SOUTH 23RD STREET 2ND FLOOR ARLINGTON, VA 22202			LUU, CHUONG A	
			ART UNIT	PAPER NUMBER
			2825	

DATE MAILED: 12/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/715,000

Applicant(s)

AOKI ET AL.

Examiner

Chuong A Luu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3, 7-19, 21, 24-33 and 57-64 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 7-19, 21, 24-33 and 57-64 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Request for Continued Examination (RCE)

The request filed on September 16, 2003 for a Request for Continued Examination (RCE) under 37 CFR 1.53(d) based on parent Application No. 09/715,000 is acceptable and a RCE has been established. An action on the RCE follows.

PRIOR ART REJECTION

Statutory Basis

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The Rejections

Claims 1-3, 11, 13, 16, 18-19, 27, 29, 32 and 57-64 are rejected under 35 U.S.C. 102(e) as being anticipated by Avanzino et al. (U.S. 6,350,687 B1)

Avanzino discloses a method of fabricating improved copper metallization by
(1) removing CuO_x from said surface and simultaneously or subsequently carrying out an anti-corrosion treatment by exposing said surface of said semiconductor substrate to a solution containing an anti-corrosive agent (see column 6, lines 33-56);

subsequently, separately forming a copper-diffusion stopper insulating film (20) over said surface of said semiconductor substrate (see column 6, lines 56-65. Figure 2);

(2) wherein said surface of said semiconductor substrate includes at least one of a copper interconnection, a copper based interconnection and a copper alloy interconnection which are formed in a damascene method (see column 6, lines 24-32);

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(3); (19) wherein said anti-corrosion treatment is carried out in a cleaning process after a chemical mechanical polishing process is carried out to said surface of said semiconductor substrate (see column 6, lines 33-65);

(11); (27) wherein a plurality of said five-membered hetero-cyclic compound comprise benzotriazole, (see column 6, lines 54-56);

(13); (29) wherein said anti-corrosive agent comprises at least one of aromatic compounds having benzene-rings and derivatives thereof (see column 6, lines 54-57);

(16) (32) wherein said copper-diffusion stopper insulating film comprises an SiN film (see column 6, lines 57-60);

(18) carrying out a chemical mechanical polishing process for forming said at least interconnection in at least a groove in said semiconductor substrate (see column 6, lines 33-65);

subsequently removing CuO_x from a surface of said semiconductor substrate using a cleaning solution and simultaneously or subsequently carrying out an anti-corrosion treatment by exposing a surface of said semiconductor substrate to a solution containing an anti-corrosive agent (see column 6, lines 33-65);

subsequently, separately forming a copper-diffusion stopper insulating film **(20)** over said surface of said semiconductor substrate (see column 6, lines 55-65. Figure 2);

(57); (60) wherein said step of carrying out an anti-corrosion treatment comprises flows the anti-corrosive agent onto the surface of the substrate (see column 6, lines 33-56);

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(58); (61) wherein said step of forming a insulating film comprises forming an insulating film by chemical vapor deposition (see column 6, lines 57-65);

(59); (62) wherein the copper-diffusion stopper insulating film comprises one of SiN film (see column 6, lines 59-60);

(63) removing metal contaminations from said surface and simultaneously carrying out an anti-corrosion treatment by exposing said surface of said semiconductor substrate to a solution containing an anti-corrosive agent (see column 6, lines 33-65);

subsequently, separately forming a copper-diffusion stopper insulating film (20) over said surface of said semiconductor substrate (see column 6, lines 55-65. Figure 2);

(64) wherein said semiconductor substrate has at least one interconnection made of a metal selected from the group consisting of copper, copper-based materials, and copper alloys, and said method further comprising the step of carrying out a chemical mechanical polishing process for forming at least one interconnection in at least one groove in said semiconductor substrate prior to said removing metal contaminations step (see column 6, lines 33-65);

Claims 8-10, 14, 24-26 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Avanzino et al. (U.S. 6,350,687 B1) in view of Lawson (U.S. 4,978,756)

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Avanzino teaches everything above except for using specific chemical compounds and concentrations for corrosive treatment and cleaning procedures. However, Lawson discloses compounds can be used for the treatment of metal **(8)**; **(24)** wherein said anti-corrosive agent comprises at least one of hetero-cyclic compounds and derivatives thereof; **(9)**; **(25)** wherein said anti-corrosive agent comprises at least one selected from the groups consisting of four-membered hetero-cyclic compounds having two nitrogen atoms, five-membered hetero-cyclic compounds having three nitrogen atoms, six-membered hetero-cyclic compounds having three nitrogen atoms and derivatives thereof; **(14)**; **(30)** wherein said aromatic compounds having benzene-rings comprise gallic acids and tannic acids; **(10)**; **(26)** wherein one of said four-membered hetero-cyclic compounds comprises indazole (see column 1, lines 4-8, lines 9-11; column 2, lines 5-66; column 3, lines 28-57; column 4, lines 4-44; column 7, lines 48-58; column 17, lines 10-50; and column 18, lines 57-68). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the above teachings by apply certain chemical compounds and concentration to manufacture a semiconductor interconnection to enhance the performance of semiconductor device.

Claims 7 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Avanzino et al. (U.S. 6,350,687 B1) in view of Admitted Prior Art (hereinafter APA)

Avanzino discloses everything above but fails to apply cleaning solution comprises a carboxylic acid. However, APA discloses a method for improving wafer

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surface with (7); (21) wherein said cleaning solution comprises a carboxylic acid based cleaning solution (see page 3, lines 1-5). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the above teachings by apply certain chemical compounds to clean a semiconductor interconnection during manufacture a semiconductor device. Doing so would facilitate the manufacture of an interconnection and increase the contacting area.

Claims 12, 15, 17, 28, 31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Avanzino et al. (U.S. 6,350,687 B1)

Avanzino discloses the claimed invention except for using SiON film as copper-diffusion stopper insulating film material; wherein said at least one of gallic acids and tannic acids, anti-corrosion agent is contained in the range of 1 ppm to 5% . It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the teaching of Avanzino by selecting SiON film as copper-diffusion stopper insulating film material and the concentration of gallic acids, tannic acids and anti-corrosion agent, which is a well-known material in the semiconductor industry, since it has been held to be within the general skill of a worker in the art to select a known material and concentration of chemicals on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Response to Arguments

Applicant's arguments filed September 16, 2003 have been fully considered but they are not persuasive.

In the light of the Applicant's argument that Avanzino do not teach or suggest removing CuOx. However, the teaching of Avanzino by treating the surface of copper layer during or subsequent to the wafer cleaning process to remove a thin native copper oxide (see column 7, lines 1-5).

Applicant argues that if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention. The argument is not persuasive because the combination references of Avanzino and APA teach the limitations of the Applicant's invention to remove CuOx; Avanzino by treating the surface of copper layer during or subsequent to the wafer cleaning process to remove a thin native copper oxide (see column 7, lines 1-5); APA teaches to improve semiconductor wafer surface having copper interconnections (see pages 1-2).

Therefore, it would have been obvious to combine the references of Avanzino and APA for removing of the oxide layer which is formed on the copper interconnection. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

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Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chuong A Luu whose telephone number is (703)305-0129. The examiner can normally be reached on M-F (7:30-4:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (703)308-1323. The fax phone numbers for the organization where this application or proceeding is assigned are (703)872-9306 for regular communications and (703)872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

CAL
December 1, 2003



MATTHEW SMITH
SUPERVISORY PATENT EXAMINER
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